The contributions of John C. Cassel as investigator, scholar and teacher continue to influence contemporary epidemiology, both in the United States and throughout the world. In anticipation of current trends in the teaching and practice of epidemiology, Cassel synthesized the concepts of the social and behavioral sciences as they affect the health of populations. The continuing impact of Cassel's innovative approach on the field of epidemiology is illustrated in a forthcoming monograph, "Family and Health: An Epidemiological Approach. Volume II" (1), and in a series of research papers to be published in a special issue of the Journal of Chronic Diseases (2).

John Charles Cassel, the son of a dentist and a physician, was born in Johannesburg, South Africa, in 1921. He received his medical education at the University of Witwatersrand, and together with his wife Margaret, a nurse, he joined the new Institute of Family and Community Health at the University, directed by Dr. Sidney Kark. (This Institute later became the clinical center of the Department of Social, Preventive and Family Medicine of the University of Natal in Durban.) The Institute was strongly oriented toward the social and cultural aspects of health and health care, and to the importance of the community's participation in its own health care. The Cassels lived and worked at the Pholela Health Center, serving a Zulu population, for six years. Here Cassel experienced at first hand the importance of cultural forces that were very different from forces he had known before in the determination of the etiology of disease and the effectiveness of health care delivery. After becoming director of the Pholela Health Center, he implemented a number of epidemiologic surveys in order to put the practice of his center on a firmer scientific base. The success of this endeavor is well documented (by Cassel (3) as well as other authors (4, 5)) and he emerged from this experience strongly committed to the need for scientific studies of a population's social and cultural, as well as biological, attributes.

In 1953, John Cassel left South Africa for the United States to obtain further training in public health at the University of North Carolina. At that time, the definition of epidemiology emphasized as its major task the understanding and con-
trol of infectious diseases, although sometimes its model was expanded to include study of nutritional, physical and chemical environmental agents. Cassel's belief in the importance of the social environment as a determinant of the distribution of health in populations, deeply rooted in his experience in the practice of medicine in South Africa, proved both innovative and controversial in the United States at that time. In 1958, when he became chairman of a fledgling Department of Epidemiology at the University of North Carolina School of Public Health, he began to include health-relevant psychological, social and cultural variables in the conceptual scheme for teaching and research in epidemiology. He attracted behavioral and social scientists to join his faculty, along with physician-, dentist- and nurse-epidemiologists. The teaching program in epidemiology began to include such subjects as culture and health, family health, epidemiologic foundations for community diagnosis, social determinants of health behavior, and research into the delivery and evaluation of health services, as well as genetic, biologic, and physiochemical-etiologic studies. North Carolina and its surrounding regions became a natural laboratory for a broad range of epidemiologic studies. A common thread woven through much of the research was his hypothesis that the world-wide process of rapid social change, manifest in North Carolina by the change from a rural, agrarian society to an urban-industrial one, placed stressors on the adaptive capacity of persons at the same time that it tended to disrupt their traditional systems of social and psychological support from others. The US part of his career was no sudden metamorphosis, but rather a continuation and growth flowing from his early experiences in Africa.

As a teacher, John Cassel demanded of himself and his faculty that each teaching session be an experience in integrative thinking. Each faculty member was encouraged to teach from a personal base of experience. Students as well as colleagues were excited by the intensity of his devotion to intellectual excellence.

He was always teaching, as often by subtle direction and subtle example as by deliberate instruction. One of his most enduring contributions could well be his influence on the dozens of people for whom he exemplified social epidemiology.

Despite his great achievements as a teacher and scientist, Cassel remained a person of great humility, never self-important or solemn, always ready to laugh at himself, always generous to others and to their ideas. He brought to life a gentle grace. At the same time, he was a man of great courage: the intellectual courage to test and fight for new ideas. He was quietly but firmly courageous and resolute in his stands for social justice in both South Africa and the United States.

John Cassel lived simply and his personal needs were modest. He was deeply devoted to his family: an indulgent and just, guiding father, and a loving and considerate husband, he was always warm and available to friends, colleagues and students.

The following acknowledgement appeared in a recent doctoral dissertation in the Department of Epidemiology at the University of North Carolina (6):

John C. Cassel, Alumni Distinguished Professor of Epidemiology at the School of Public Health, University of North Carolina, was my doctoral advisor to his death in 1976. It is impossible to encompass, in a brief description, the unique combination of qualities that made him so unusual a teacher, leader and humanist. John Cassel was surrounded by an aura of intense excitement, warmth, and stimulation. This, together with his remarkable intelligence, logic and wit, bold originality and the ability to cut through the maze of sometimes cloudy thinking (of others) to reach for the central issue, or to detect an idea of value, made working with him and learning from him such an unusual privilege and pleasure.

His concept of health was all too rare—a
holistic one, never treating the soma as an entity unto itself, devoid of, or separate from the psyche or social environment (but, rather, viewing health outcomes as resultants of interactions of man with his environment, with special emphasis on the social and cultural environment), whilst at the same time considering health and disease at all levels of biologic organization—from the highest macro-level of social organization to the lowest micro-level, the subcellular or biochemical. In this integration of concepts lies, I believe, a very special contribution.

The legacy of John Cassel is deep in the hearts and minds of many people in many parts of the world, in those of his patients, colleagues, students, his family and his friends. The annotated bibliography of his publications that follows this article has been prepared by the faculty and students of the Department of Epidemiology, University of North Carolina School of Public Health.

SELECTED ANNOTATED PUBLICATIONS OF JOHN C. CASSEL


Cassel here launched the development of his concepts, his experience among the Zulu community having allowed the formulation of his ideas. He described the social and cultural factors that relate to health care and the determinants of illness, and illustrated the importance of incorporating these factors in the provision of health care programs.


This was the first publication to explicate a systematic conceptual scheme that was to underpin much of Cassel's later epidemiologic work. Epidemiology was viewed as an analytic science concerned with processes determining health states in groups, and a linked, open system theory was outlined, in terms of which these processes could be sought at any or all of the following levels of abstraction: biochemical, physiological, psychological, social and cultural.


This study was explicitly designed to test the predicted deleterious health consequences of recent and rapid culture change (as identified in the last-cited paper). It was postulated that first generation factory workers in rural western North Carolina, who were the first of their families to move into the industrial milieu, would experience more ill-health than would similar workers whose fathers before them had had contact with
factory employment. These expectations were confirmed with measures of general morbidity and illness absenteeism.


The importance of social and cultural factors in determining response to health programs is highlighted in this paper. Here, Cassel emphasized the need for awareness that human behavior is socially determined and not only a product of cognitive and other individually-based responses.


The consequences of urbanization on coronary heart disease (CHD) mortality were ecologically assessed within the state of North Carolina in this study. It was postulated that CHD mortality would be greatest among rural residents of areas in which urbanization was taking place, as a consequence of their unpreparedness for the demands of modern lifestyles. The empirical findings confirmed the predictions. Interestingly, although rural residents exhibited increasing CHD death rates from 1950 to 1960, urban residents did not show increased rates over time, heralding the period of plateauing of CHD mortality followed by the current decline. These findings were consistent with the conceptualization and hypotheses developed earlier.


In this paper, which strengthened the bridge between social science and medicine, Cassel urged that the identification and classification of clinical entities be re-evaluated in light of the social characteristics of the individuals manifesting these illness behaviors. He stressed the value of recognizing a combined social, cultural, physical and biological development of illness in order to enhance our understanding of disease etiology.


Here Cassel commented on the striking consistency of findings from a wide variety of studies that show that groups exposed to socio-cultural incongruity and rapid change have higher rates of cardiovascular diseases than comparable groups not so exposed. He explicated three models of causation used by investigators in attempting to link these "stressors" to CHD, and he postulated a fourth model hypothesizing that groups exposed to these factors will manifest a wide spectrum of disease consequences.


In this work, Cassel reviewed animal experimental and human population data on blood pressure (BP) relevant to the possible role of psychosocial factors in essential hypertension. The theoretical construct developed is that arousal of the defense-alarm response prompted by stressors in the social environment may lead to essential hypertension. The conditioning effect of social learning and preparedness for environmental insults, adaptation to them, and protection from their effects by social support,
each might modify the hypertensive response to these otherwise threatening stimuli. The work provided a synthesis of the concepts of hypertension-relevant neurophysiology and epidemiology, and provided a conceptual framework for the derivation of operational hypotheses, which can be tested in human epidemiologic studies.


The changing nature of diseases afflicting Western society in the last 100 years was examined. Epidemics of diseases such as tuberculosis and rickets were stated to have waned, and to have been superseded by modern epidemics of diseases such as CHD, cancer, diabetes, hypertension and mental disorders. Cassel cited evidence that these disorders have reached a peak and are now on the decline. Noting that current explanations of these changes in disease patterns were unsatisfactory, Cassel reviewed animal and epidemiologic data, and he put forth one possible set of factors—the social processes that increase susceptibility. His suggestion for research strategies included the identification of situations most likely to invoke adaptive responses, and identification of the determinants of the particular adaptations utilized by different segments of the population.


This paper was an introduction to a special issue which reported the results of a seven-year follow-up of the Evans County cohort. This biracial, predominantly rural, agrarian community was kept under epidemiologic surveillance following a prevalence survey in 1960. In addition to quantifying the importance of the now well-known standard and strong risk factors, the importance of psychosocial factors was emphasized. The earlier cross-sectional results indicated a marked gradient by social status, with prevalence of CHD higher in white upper social class than white lower social class men. On follow-up, the social class differences were eliminated. These data of changing social class patterns of CHD were anticipatory of similar results reported internationally, e.g., from Great Britain, and they were consistent with theoretical expectations based on changes in life-style and their impact in the lower social class in Evans County.


Consistent with the central objectives of epidemiology, here Cassel examined those social factors in man's environment that influence health. He stated that while it was widely thought that psychosocial processes may be important in disease etiology, the evidence was that the role of such factors in epidemiologic studies has not been clear-cut, indeed it was often conflicting or confusing. Cassel's thesis was that this problem resulted from an inadequate theoretical framework and uncritical acceptance of the social stress theory. Cassel's evolving formulation focused on a failure to recognize that psychosocial processes are unlikely to cause pathological changes directly. After reviewing relevant animal and human
studies, Cassel first emphasized the importance of understanding that social processes can be related to increased susceptibility to a variety of diseases and second stated that our model should examine modifying or protective social bonds.

12. Cassel JC: Psychiatric epidemiology. In The American Handbook of Psychiatry. Volume II. Edited by G Caplan. Basic Books, New York, 1974, pp. 401-410. This is a selected review of the important landmark studies in psychiatric epidemiology. Although applauding the efforts made thus far, Cassel argued that further important progress will not occur unless more rigorous criteria are developed for defining cases that would be suitable for epidemiologic study.

13. Kaplan BH, Cassel JC (Eds): Family and Health: An Epidemiological Approach. Monograph. Chapel Hill, NC, University of North Carolina Institute for Research and Social Science, 1975. Here was reflected Cassel's interest in the function the family has in determining the health and well-being of its members. He showed that remarkably few attempts have been made to develop scientifically valid data on the relations between family life-styles and health and well-being that could be useful to policy-makers and physicians engaged in personal health care. The theory that integrates this monograph is that susceptibility to a wide variety of diseases and disorders is influenced by a combination of exposure to psychosocial stress and the possible protection afforded by adequate social support.

14. Cassel J: Studies of hypertension in migrants. In Epidemiology and Control of Hypertension. Edited by O Paul. New York, Stratton Intercontinental Medical Book Corporation, 1975, pp. 41-61. Cassel here reviewed a number of studies bearing on the question of whether moving from small, cohesive societies into the modern world may be part of the etiology of hypertension. Studies of similar people living under different degrees of culture contact showed consistently higher BP levels among the modern groups. With a few exceptions, studies of societies undergoing modernization showed higher BPs among the more modern segments. And studies of migrants to more modern societies showed higher rates of elevated BP among the migrants. In order to assess the role of physical factors and/or psychosocial factors, Cassel urged prospective studies that will control for the selective factors that may be involved in migration.

15. Kaplan BH, Cassel JC, Gore S: Social support and health. Med Care 15:47-58, 1977. While many researchers have speculated on the importance of social support, and a few have claimed it to be especially significant in CHD, Kaplan et al. here said that there is little evidence to confirm the role support plays in health and illness. They stated that this is not surprising, due to inadequate measurements and post hoc interpretations of the results. Animal studies were cited which have shown that the presence of another animal of the same species under certain circumstances offers protection against stressful stimuli. The emphasis in this paper was on the importance of social support in protecting health. Key questions were posed for...
future research with suggestions for a new synthesis of the types of social support.

16. Cassel J: The contribution of the social environment to host resistance. The Fourth Wade Hampton Frost Lecture. Am J Epidemiol 104:107–123, 1976. This paper forms a fitting capstone to Cassel's written works. Prepared and presented during his terminal illness, Cassel brought his concepts together in this address. In it, he covered the processes by which social forces determine responses to stimuli, provide protection against noxious stimuli, and promote well-being. He illustrated how such forces should be incorporated into preventive and promotive health programs.